

Supply Chain Resilience Framework for Covid-19 Pandemic Era

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Abstract

Covid-19 Pandemic has changed the way of life and many sectors of human activities, including the business way. The companies that want to survive and win the business during this pandemic, must have a supply chain resilience (SCR); hence, they can adapt and change their business way. This study tries to tackle this phenomenon by identifying the important factors to strengthen the SCR and formulating the SCR framework for companies to survive this global disruption, especially for those that operate in Indonesia. Based on the framework that has been developed, there are several changes that companies need to make for gaining a SCR. The companies must change the way of interaction with suppliers and consumers as well as the way they produce or operate.

Keywords

Supply chain, Resilience, Framework, Covid-19, Pandemic

1. Introduction

Since the end of 2019, the world has been facing an unprecedented pandemic, which is Covid-19. Until 18 July 2020, the total global confirmed cases of Covid-19 are 13,876,441 and the fatality rate is 4,27%, which means 593,087 people died due to this virus (WHO, 2020). The high numbers of confirmed and dead cases are due to the ease of the infection and the spread of this virus. This condition leads to disruption in both the healthcare system and economics (Hartley and Perencevich, 2020) and makes the Covid-19 pandemic become the worst pandemic during these past hundred years (Barach et al, 2020).

To overcome this pandemic, many countries, including Indonesia, implement new strategies such as lock-down, work and school from home, and social and physical distancing. These policies make some changes such as the change of consumer behavior, the increasing internet usage and stay at home lifestyle (Yuswohady et al, 2020). The survey conducted by (Yuswohady et al, 2020) also stated that there are 4 (four) consumer mega shifts as the effect of the Covid-19 pandemic; those are society, stay at home lifestyle, the bottom of the pyramid and go virtual.

These changes affect many sectors, including the business sectors. Many businesses must adjust their operations and strategy to fulfill the customer demand, thus they can survive during this global pandemic. Based on Fiksel (2006), the ability of a company to adapt when encountering the change, then survive, and might even grow through this process is defined as Supply Chain Resilience (SCR).

Since the emerging and rising number of disruptions around the world, supply chain resilience (SCR) has become a popular topic to be studied since the early 2000s (Fiksel, 2006). Many researchers studied SCR to survive disruption such as natural disasters, financial crises, pandemic, etc., but to the best of authors' knowledge, there are still few SCR studies regarding the Covid-19 pandemic. Since the characteristics of Covid-19 disruption is not the same as those of

previous disruptions, the SCR framework during the Covid-19 pandemic might be different from the existing SCR framework. Hence, it is essential to identify factors of SCR to survive the Covid-19 Pandemic.

Considering this research gap, this study focuses on SCR during the Covid-19 pandemic, addresses factors that determine the SCR during the Covid-19 pandemic, and identifies the supply chain before and after the pandemic Covid-19. In other words, this study aims to address factors that influence and build the SC resilience during the Covid-19 pandemic and the factors that should be owned by the company to get through this pandemic.

Based on the authors' knowledge, there is no Supply Chain Reliance Framework for companies to survive during the Covid-19 pandemic, especially for the companies in Indonesia. Based on this problem description, this study has two research questions. First, what are the factors and the relationship between those factors that contribute to the development of the company's SCR framework during the Covid-19 pandemic era. Second, what is the suitable SCR framework for surviving the Covid-19 pandemic, especially for companies in Indonesia.

Therefore, the main contribution of this study is proposing SCR factors for the Covid-19 pandemic. The SCR framework may be different from the existing SCR framework, since the Covid-19 pandemic has different effects with other disruptions or disasters, such as it is global around the world, long-lasting pandemic, easy to spread, make the consumers change their behavior such as stay at home, online transaction, lockdown policy, and work or school from home policy.

2. Literature Review

Many scholars have studied supply chain resilience. Pujawan et al. (2009) propose a framework for supply chain resilience for Disaster Relief Operation (DRO). The framework consists of four elements, these are information visibility, coordination, accountability, and professionalism. Then the framework is evaluated to two companies in Indonesia.

Another scholar, Pereira and Da Silva (2015) found that there are intra and inter-organizational issues that challenge to help enhance supply chain resilience. The intra-organizational issues are knowledge, internal inventory, product, technology, and risk. Then for inter-organizational issues, there are strategic sourcing, supply chain design, transportation, and external inventory.

Singh et al. (2019) conducted a wide literature review. Based on the review, they developed a supply chain resilience framework. The framework consists of 17 (seventeen) indicators which are divided into 3 (three) stages of SC resilience. The stages are the anticipation stage, resistance stage dan response, and recovery stages. In the anticipation stage, there are visibility, awareness, security, sustainability, and SCRM. For resistance, the phase is flexibility, redundancy, collaboration, supply chain network, revenue sharing, and robustness. For the last phase, there are visibility, agility, public-private partnership, adaptability, market position, and information sharing.

Another scholar, Park et al. (2013) proposed a supply chain management disruption response model and studied four manufacturing companies in Japan to take lessons learned. In their paper, it is stated that virtual supply chain dispersion, SCDI (supply chain design information), and portability become key elements for successful strategy in response to the disruption (earthquake, disaster, etc.).

Dixit et al. (2020) performed a study based on simulation. They define SCR as the composite effect of centrality, density, network size, and connectivity of the network. Then simulation-based approach is done to evaluate the performance of SCR using conditional value at risk (CVaR). The simulation results from 23 firms shown that a firm with the lowest density and centrality and the highest connectivity and network size, has the highest resilience, while the firm with the highest density and high centrality shown the lowest resilience.

Pettit et al. (2010) developed a conceptual framework for supply chain resilience which has great potential for providing management insight. The supply chain resilience framework developed in this study pinned point two constructs, such as supply chain vulnerability and supply chain capability as attributes to implement the supply chain framework. According to the study, the developed framework can balance supply chain capabilities and supply chain

vulnerabilities. As a result, when a portfolio of capabilities matches the pattern of vulnerabilities, supply chain performance will be able to improve.

However, in the previous studies, unfortunately, the pandemic has not been one of the factors that contribute to vulnerability. The pandemic is disruptive and weakening various businesses, and there are no best practices yet to bounce back even stronger. Therefore, a study is needed to investigate what companies actually feel in the pandemic era. Covid-19 cannot be denied as a turbulence which has uncertain implications for companies, at worst is business bankruptcy. Companies are confused about the uncertainties on the demand and supply side. From the supply chain management (SCM) perspective, disruptions at certain points in supply chain activities weaken the performance of the entire network. The weak performance for some companies requires extra effort to rise. The resilience of a company is reflected in the process of surviving, adapting, and growing (Fiksel, 2006). However, this resilience cannot be understood partially, because business is a series of collective activities involving various companies from upstream to downstream. Thus, the lens used in resilience is a systems approach (Pettit et al, 2019). Therefore, this paper contribution is to propose a SCR framework for companies during the Covid-19 pandemic era.

3. Research Methodology

In determining the SCR framework during the pandemic covid-19, it is done a lot of literature review. The references are from research paper, journal paper or conference paper, about SCR and some report about covid-19 related with supply chain and consumers. Then SCR framework for covid-19 will be proposed. After that a case study will be investigated and analyzed toward the proposed SCR framework to get some lessons learned. The research methodology is described in Figure 1 below.

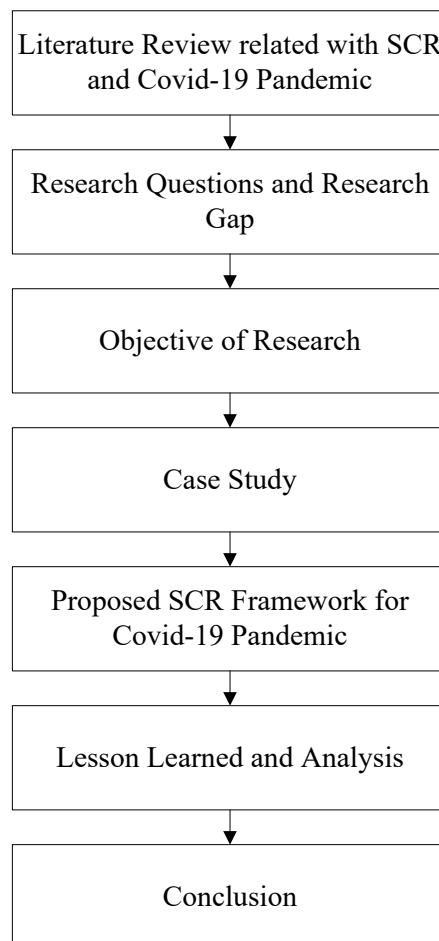


Figure 1. Research methodology of SCR framework for Covid-19 pandemic

4. Case Study

A case study is performed in a large food and beverages distributor company in Indonesia. Based on the case study obtained in the field by conducting interviews, there are several differences in conditions between before and after Covid-19 pandemic. It can be seen in Table 1 and Figure 2 that there was a surge in product sales from March and April 2020. This was due to the panic buying effect on consumers where there was excessive fear if food ingredients ran low during the pandemic. But then there was a very significant decrease in May and June because many food supplies had been stored by consumers. And in July there was an increase in product sales again because food supplies to consumers were running low again.

Table 1. Sales Volume of Food and Beverages Distribution in year 2022

No.	Month	Sales Volume (in Rupiah)
1	January	Rp161.262.197.386
2	February	Rp147.278.611.607
3	March	Rp152.502.096.554
4	April	Rp192.240.674.824
5	May	Rp125.390.838.273
6	June	Rp127.035.218.424
7	July	Rp137.223.130.736
8	August	Rp137.132.624.138
9	September	Rp140.691.269.489
10	October	Rp167.118.196.330
11	November	Rp149.822.877.830
12	December	Rp167.896.146.226



Figure 2. Product sales as the effect of Covid-19 Pandemic in 2020

There has been a significant increase and decrease in product sales due to the effects of the pandemic which have had an impact on the company itself. One of them is related to mobility, where the auditors cannot directly review the condition of the company. The effect that occurs is that product sales just get stuck there. In addition, several products

such as snacks and other complementary products also experienced a decline in sales. Because consumers prefer to buy primary product and various kinds of health products to be able to boost their immune system.

In addition to the above, the effects of the Covid-19 pandemic have also hampered the product delivery process in several cities. Thus, causing a delay in delivery. One of the problems experienced is a permit to enter the city that has not been taken care of or indeed regulations from the local regional government which do not allow other vehicles to enter their area. With these problems, causing an increase in shipping costs.

5. The Proposed SCR Framework

The challenge in proposing SCR for Covid-19 framework is because of the change of consumer behavior rather than its pandemic itself. It means that the Covid-19 pandemic has made some drastic and hard to predict changes in consumer behavior. Therefore, the proposed SCR framework must be able to address and overcome these changes, that may be different from others or previous disruptions.

The background in developing the SCR framework for Covid-19 is described in Figure 3. Based on Figure 3, the global pandemic has made such as cycling effect and impact for each party involved. Based on this figure, the company needs to implement any new strategy for its supply chain, both inbound and outbound supply chain. So that the company can survive in the pandemic era and still be able to meet the customer demand.

According to Figure 3, it can be seen that both parties, consumers and suppliers, have a lot of changes. The company must implement and make some adjustments for its supply chain, to survive and still can fulfill the customer demand. SCR framework for Covid-19 consists of three building blocks, these are:

1. Interface between suppliers-company (inbound side)
2. Internal company
3. Interface between company-consumers (outbound side)

Based on the existing condition as the effect of the Covid-19 pandemic, then it is proposed the framework for supply chain resilience during the Covid-19 Pandemic. The proposed framework is presented in Figure 4 below. Based on Figure 4, to survive in this pandemic, the companies must be able to adapt and change the way of their interaction with suppliers and customers, and also the way they produce. Some changes that must be done in the interface between supplier and company are consist of six points. First is supplier coordination. Second is supplier substitution. Third is to broaden the supplier network and cooperation. These three points help the company to have supplier flexibility, bargaining power in front of the supplier, an improvement in supplier engagement since the company can help supplier in production planning or forecasting. However, supplier substitution strategy can harm a company that has a loyal working environment, especially for companies in Asia, such as Indonesia. Thus, these three strategies must be adjusted based on the situation. Fifth is through IT implementation for transactions. Sixth is utilizing big data technology. The last two points become crucial in the pandemic era since those can reduce the risk of meeting people and help to record as well as transfer many important data which can be useful for supplier coordination.

For the changing in the internal company production is consist of four points. First is demand forecasting or demand visibility, which becomes essential when there is a change in the customer behavior, especially for the unpredictable change like that happens during the pandemic. Second is IT implementation for the internal company. Third is the implementation of part or component or product substitute. Fourth is the implementation of warehouse management. The last two point is important when there is panic buying that happened in the beginning of pandemic or when the lock down policy announced.

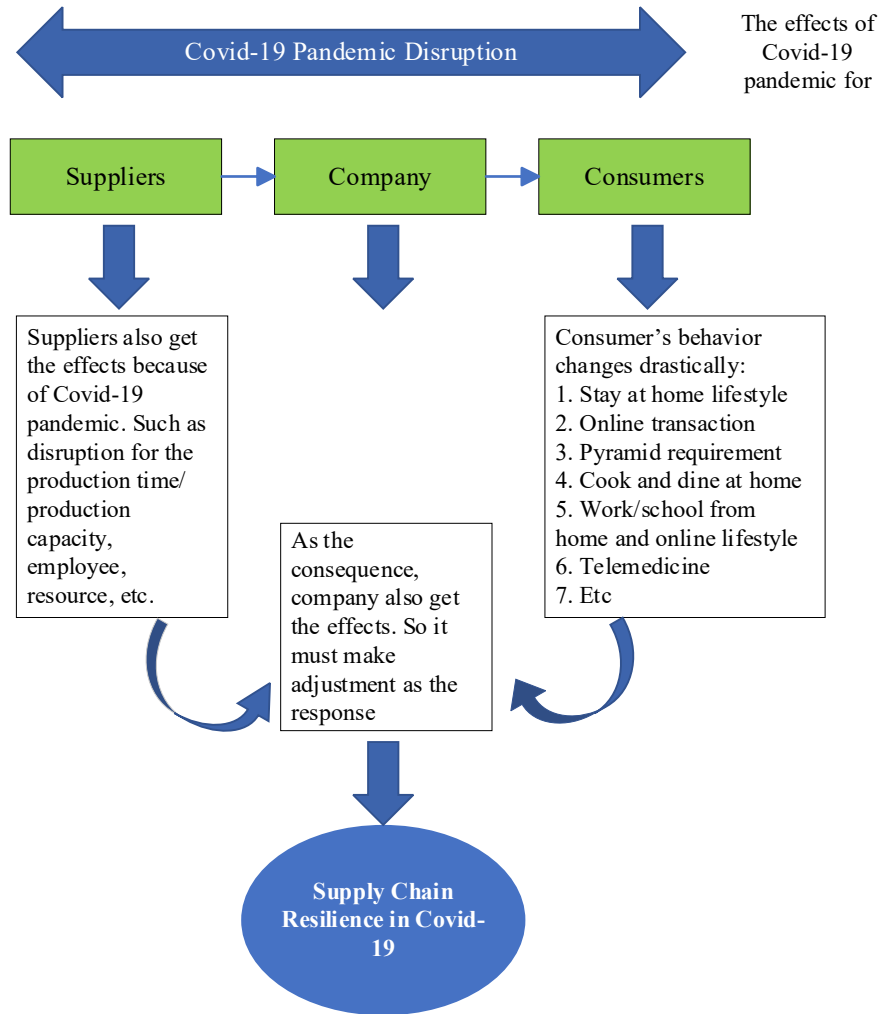


Figure 3. The existing condition as the effect of Covid-19 Pandemic

The last section is the adaptation that must be done in the interface between company and customers. Seven points must be adapted in the interface between the company and customers. First is the determination of better routing (rerouting). It is important to minimize the transportation cost, as transportation cost becomes almost 30% of the product cost. Second is an adaptation for the mode of transportation. In this pandemic era, the companies must be able to select any available alternative transportation for the product distribution. Some countries such as the United States of America, Italy, and other countries in Europe have utilized drones for shipping the products, which is more convenient and safer during this pandemic. Third is promoting for online shopping style. Nowadays, it is very helpful and very useful for companies offering online shopping for customers, to minimize the risk if they must go outside for shopping offline. Fourth is Digital transactions. Fifth is Delivery service. Sixth is to provide Cash on Delivery (COD) payment. Lastly is utilizing big data. Big data utilization can be useful for supporting demand forecasting and predicting the customer behavior changes in the pandemic era.

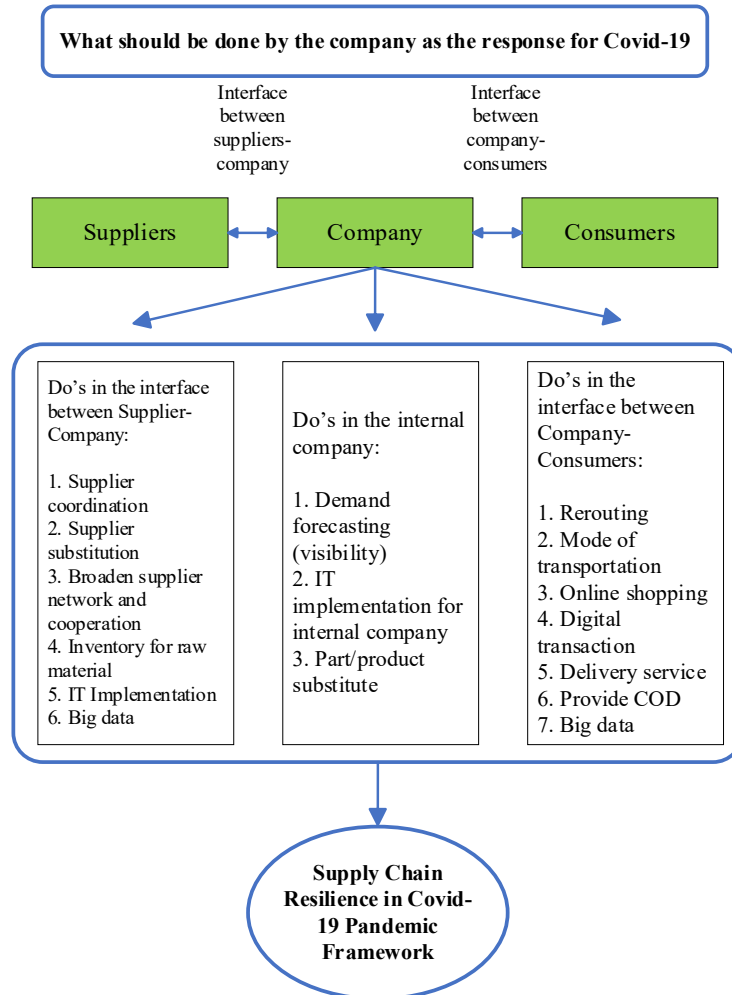


Figure 4. The Proposed Framework for SCR during Covid-19 Pandemic

6. Framework Validation and Analysis

To validate the proposed framework for SCR during Covid-19 Pandemic, it is conducted survey for asking the people opinion regarding the proposed framework. The survey results that 82,5% respondents (7 respondents) said that the proposed framework is good, while 17,5% said need revision (1 respondent). The result of the survey is presented in Table 2 and Figure 5. The respondents are coming from business sector, education, consultants, and other sectors. Based on the survey, it is concluded that the proposed framework is good as the company's guideline for mitigation steps of Covid-19 pandemic responses.

Table 2. Survey Result

Respondent	Opinion
1	Good
2	Good
3	Need revision
4	Good
5	Good
6	Good

7	Good
8	Good

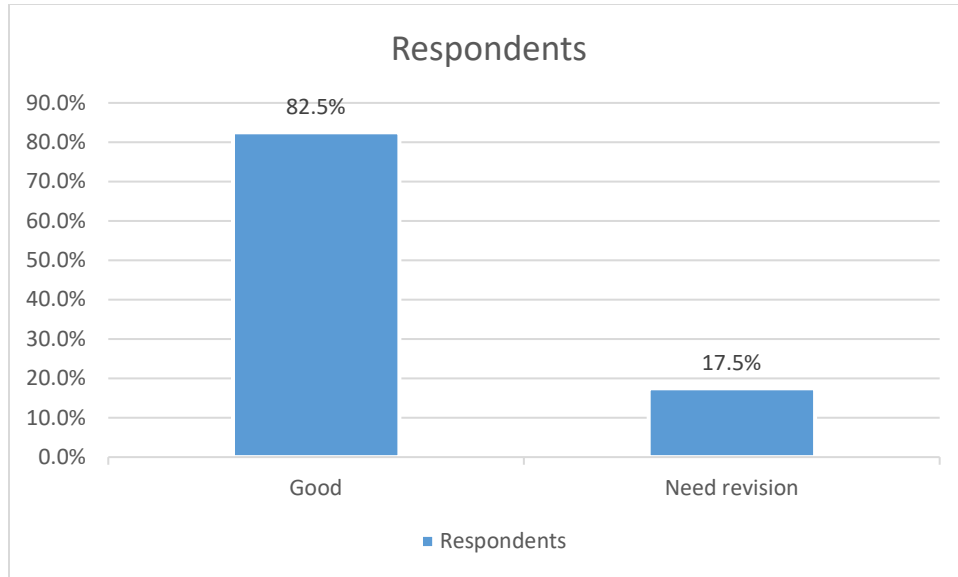


Figure 5. Framework validation result

Based on case study and data obtained through interviews and various literature reviews, there are several problems that have arisen from both the supplier, company, and consumer due to the Covid-19 pandemic. From this data it can be seen that the effects of the Covid-19 pandemic on suppliers have caused disruptions related to production time, production capacity, and human resources. And this will certainly have an impact on companies and their consumers. Coupled with changes in consumer behavior during the pandemic, where all activities can be carried out at home and do not communicate directly with other consumers.

Therefore, this research was conducted to bridge these problems so that later suppliers, companies, and consumers are able to adapt to post-pandemic conditions Covid-19. It can be seen in Figure 4 which is a proposed supply chain framework for suppliers, companies, and consumers. In the proposed framework, suppliers must be able to improve coordination, implement IT, and provide big data. Meanwhile, companies can forecast consumer demand based on pre-existing trends. And from the consumer side, the use of IT and online shopping will be maximized to facilitate the transaction process between consumers and companies.

7. Conclusion

The Covid-19 pandemic is a long and global disaster which has a big impact on people's life in every sector. Based on the framework that has been developed in this study, it is shown that the Covid-19 pandemic also makes a change in the way of business. Companies that want to survive and win during this pandemic, must have a supply chain resilience thus they can adapt and change their business way. These changes include the change of interaction with suppliers and consumers as well as the way they produce or operate. This study focuses on identifying the important

factor for building supply chain resilience and developing a supply chain resilience framework for companies that operate in Indonesia.

There are several important factors for gaining supply chain resilience, which can be grouped in the three interfaces. Those are the interface between supplier and company, the interface in the internal company, and the interface between company and consumers. In the interface between supplier and company, there are six important factors for building a SCR, those are supplier coordination, supplier substitution, broadening the supplier network and cooperation, improve IT implementation for transactions, and utilizing big data technology. In the interface for an internal company, there are four important factors for gaining a SCR, those are demand forecasting or demand visibility, improving IT implementation for internal company, the implementation of part or component or product substitute, and the implementation of warehouse management. In the interface between company and consumers, there are seven important factors for improving a SCR, those are the determination of better routing (rerouting), an adaptation for the mode of transportation, promoting for online shopping style, using digital transactions, using delivery service, and provide COD payment.

As the future work, so this study must be continued to do case studies for companies that received a big impact because of this pandemic. The companies can be such as fashion companies, parcel or logistics, food and beverages companies, retailers, etc. These case studies can give important lessons learned about what should do and do not, for surviving and winning during this pandemic.

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Biography

Dwi Agustina Kurniawati, Ph.D. is an Associate Professor in Industrial Engineering, Faculty of Science and Engineering, Universitas Islam Negeri (UIN) Sunan Kalijaga, Indonesia. She finished her bachelor's degree in

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